ELIMINATING SHUTDOWN WATER FLUSHING ON LARGE PROCESS UNITS
The equipment in an operating coker is hot, dirty, and full of toxic and explosive gas.

When you shut it down for **turnaround**, it **must** be done;

- **SAFELY**
- **EFFICIENTLY**
- **RAPIDLY**
CANADIAN OILSANDS COKER FRACTIONATOR – LEGACY METHOD

Water flushed to remove oil

Steam to flare to “decontaminate”

Install Blinds, spools and temporary tanks & pumps and circulate soap and water

Steam to atmosphere to remove remaining benzene, LEL and H2S
Canadian Oilsands Coker Fractionator Water Flush Results?

- LEL, H2S, Benzene vented to open tanks and atmosphere - alarms
- Pyrophoric fire in overhead demister
- Oil and chemistry on ground and sewers, overflowing drain hubs
- Personnel required to wear chemical resistant suits when on the unit

- Substantial blinding required
- Temporary pumps, hoses and tanks rented, and effluent emulsion was very difficult to break, costly disposal for large effluent volumes (>1500m$^3$)
- Only certain sections clean, requiring secondary cleaning DURING the turnaround

- Duration estimate was 64 hours of cleaning from “oil out” to “ready for maintenance”
- Actual time was 146 hours
- Coker frac and WGC were critical path, both delayed over 80 hours
In 2015, the turnaround manager was directed to improve upon this performance, especially in regards to personnel safety and environmental releases.

Our company was contracted to provide a solution to decontaminate, clean and treat pyrophoric iron sulfides in this coker fractionator...it needed to be done as below

SAFELY

EFFICIENTLY

RAPIDLY
Before shutdown, install temporary drain piping, cooler and pump
Steam to flare
Open drains to temporary drain header
Pump condensate and effluent to slops
Inject chemistry to remove oil, H2S, benzene
Inject chemistry to treat pyrophorics
Batch rinse to clean and cool
Canadian Oilsands Coker Fractionator
Vaporphase Results?

**SAFELY**
- LEL, H2S, Benzene removed to slops and flare, no gas releases
- No odors, spills, gases to environment
- Tower was gas free, cool, clean and dry
- Only non-organic solids remained
- No pyrophoric activity at all
- All personnel could work without additional PPE

**EFFICIENTLY**
- Only required small mechanical connections
- Vendor supplied drain header and hoses with all certifications
- No temporary tanks required, no effluent treatment needed, all chemistry and effluent reprocessed in slops.

**RAPIDLY**
- Duration for the clean was 46 hours from “oil out” to “ready for maintenance” which was 7 hours ahead of schedule
- The frac was done in parallel with the LER, WGC, blowdown
WATER FLUSHING METHOD (pre 2015)

EFFLUENT VOLUMES GENERATED
• FRACTIONATOR  1830m³
• LIGHT ENDS RECOVERY  440m³

SHUTDOWN DURATION
• 146 hours

# OF FLAME RESISTANT RAIN SUITS
• 300 @ $550 each

# OF HALF MASK RESPIRATORS
• 300 @ $65 each

# OF GAS RELEASE INCIDENTS
• >20 incidents of high LEL% or H2S hits

COST OF POST TURNAROUND CLEANING
• $39,000
• 22 hours lost

VAPORPHASE METHOD (post 2015 and current)

EFFLUENT VOLUMES GENERATED
• FRACTIONATOR  225m³
• LIGHT ENDS RECOVERY  130m³

SHUTDOWN DURATION
• 47 HOURS

# OF FLAME RESISTANT RAIN SUITS
• none

# OF HALF MASK RESPIRATORS
• none

# OF GAS RELEASE INCIDENTS
• None

COST OF POST TURNAROUND CLEANING
• $0
In the USA, the MACT CC rules require refiners to limit venting to the atmosphere; equipment must be <35kPaG and <10% LEL before opening to the atmosphere.

This encouraged the use of cleaning and decontaminating equipment before opening to the atmosphere, and this is best achieved with a steam out to flare and to a closed temporary drain header system.

In the USA today, water flushing refinery units has been almost completely replaced by the vaporphase cleaning method. Not only is it better for the environment and people, it reduces shutdown timelines and allows the turnaround to start on time without having to do decontamination and cleaning DURING the turnaround maintenance activities.
Refinery shutdowns should not be considered exceptions to safe operating practices.

- High point venting to remove benzene, H₂S, and VOCs to the environment should be eliminated.
- Draining oil and effluent to open containers or directly to the floor of the unit is a bad practice.
- Large volumes of waste effluent are costly to contain, transport, and reprocess.
- Personnel should not be exposed to dirty working environments with risk of gas exposure or pyrophoric fires.